

REMARKS

Claims 16-27 are pending in the present application. Claims 16-27 have been presented herewith. Claims 10-15 have been canceled.

Claim Rejections-35 U.S.C. 103

Claims 10-15 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Tahara et al. reference (U.S. Patent No. 5,356,515) in view of the Yamada reference (U.S. Patent No. 5,827,778) and the Pu et al. reference (U.S. Patent No. 5,843,847). This rejection, insofar as it may pertain to the presently pending claims, is traversed for the following reasons.

The method of forming a conductive path in a semiconductor device of claim 16 includes in combination "etching the second insulating layer using the etching mask in a reaction chamber, wherein a reaction chamber pressure is not less than 100 mTorr, a reaction gas essentially consists of CHF₃ and CO, a flow ratio of CHF₃ and CO is about 15/85, and a flow rate of the reaction gas is not less than about 300 sccm, so that the second insulating layer under the opening of the etching mask is removed and an etch stop occurs". Applicant respectfully submits that the prior art as relied upon by the Examiner does not make obvious these features.

The Examiner has acknowledged in the Final Office Action dated July 21, 2003, that the Tahara et al. reference does not disclose a flow ratio of about 15/85. In order to overcome this acknowledged deficiency of the Tahara et al. reference, the Examiner

has asserted that the Yamada reference "teaches the effect of etching rate as a function of flow ratio of CHF_3/CO including a flow ratio of about 15/85 (see Fig. 6)". The Examiner has further alleged that it would have been obvious to one of ordinary skill to use a suitable flow rate of CHF_3/CO as disclosed by Yamada in order to have a desired etching rate. Applicant disagrees for the following reasons.

As described on page 4, lines 2-7 of the present application, when the flow rates of CHF_3 and CO are set at about 30 sccm and about 170 sccm (or in other words at a flow ratio of 15/85), by placing the etching mask within a permissible placement error, it is possible to prevent the etched hole from reaching a region where a problem such as a short circuit caused by misalignment of the etching mask could arise. As further described on page 4, lines 13-19 of the application, when the flow rates of CHF_3 and CO were set at about 45 sccm and about 255 sccm (a flow ratio of about 15/85), the etching stop phenomenon was witnessed in which the etched hole did not advance deeper than about 100 nm from the surface of the conductive member. As described beginning on page 10, line 21 of the application, if the permissible placement error of the resist mask 26 as shown in Fig. 1(c) for example is limited to 0.04 μm and the resist mask 26 is placed properly within this error limit, by performing the etching process as described with a mixed reaction gas of CHF_3 and CO at a flow ratio of about 15/85, the unaligned portion due to the offset of the etched hole never reaches the lower electrode member even if there is an offset within the permissible error.

As acknowledged by the Examiner, the Tahara et al. reference does not disclose

the flow ratio of CHF_3 and CO of about 15/85 as featured in claim 16. Applicant particularly notes that the flow ratio of CHF_3/CO in Table 1, column 16 of the Tahara et al. reference as relied upon by the Examiner is 45/155, or more particularly about 15/51. This value of flow ratio as disclosed by the Tahara et al. reference is not even remotely close to the flow ratio as featured in claim 16.

As further noted above, the Examiner has asserted that a flow ratio of about 15/85 is disclosed in Fig. 6 of the Yamada reference. However, Fig. 6 of the Yamada reference discloses a ratio of flow rate of CO with respect to the total flow rate of CHF_3 and CO. Fig. 6 of the Yamada reference does not specifically illustrate a flow ratio of CHF_3/CO . Accordingly, it is not understood how Fig. 6 of the Yamada reference discloses a flow ratio of CHF_3/CO of about 15/85, as asserted by the Examiner.

As noted above, the flow ratio of CHF_3/CO of about 15/85 as used with the various additional parameters as set forth in claim 16 enables an etch stop so that the etched hole does not reach a region where a problem such as a short circuit caused by misalignment of an etching mask may occur. The prior art as relied upon by the Examiner does not disclose or even remotely suggest a flow ratio of CHF_3 and CO of about 15/85 as used with the various parameters as featured in claim 16. Applicant therefore respectfully submits that the method of forming a conductive path in a semiconductor device of claim 16 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 16-21, is improper for at least these reasons.

The method of forming a conductive path in a semiconductor device of claim 22 includes in combination “etching the second insulating layer using the etching mask in a reaction chamber, wherein a reaction chamber pressure is not less than 100 mTorr, a reaction gas essentially consists of CHF_3 and CO, a flow rate of CHF_3 and CO is about 15/85, and a flow rate of the reaction gas is not less than about 300 sccm, so that the insulating layer under the opening of the etching mask is removed to expose the conductive member and an etch stop occurs”.

Applicant respectfully submits that the prior art as relied upon by the Examiner does not make obvious the above noted features of claim 22, for at least somewhat similar reasons as set forth above with respect to claim 16. Applicant therefore respectfully submits that the method of forming a conductive path in a semiconductor device of claim 22 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that this rejection, insofar as it may pertain to claims 22-27, is improper for at least these reasons.

Conclusion

The Examiner is respectfully requested to reconsider and withdraw the corresponding rejection, and to pass the claims of the present application to issue, for at least the above reasons.

In the event that there are any outstanding matters remaining in the present application, please contact Andrew J. Telesz, Jr. (Reg. No. 33,581) at (571) 283-0720

in the Washington, D.C. area, to discuss these matters.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment for any additional fees that may be required, or credit any overpayment, to Deposit Account No. 50-0238.

Respectfully submitted,

VOLENTINE FRANCOS & WHITT, P.L.L.C.

A handwritten signature in black ink, appearing to read "A. J. Telesz, Jr.", with a stylized flourish at the end.

Andrew J. Telesz, Jr.
Registration No. 33,581

11951 Freedom Drive, Suite 1260
Reston, Virginia 20190
Telephone No.: (571) 283-0270
Facsimile No.: (571) 283-0740